Contribution ID: **19** Type: **oral**

Spin-Off Application of Silica Aerogel in Space: Capturing Intact Cosmic Dust in Low-Earth Orbits and Beyond

Wednesday, May 24, 2017 2:18 PM (18 minutes)

Since the 1970s, silica aerogel has been widely used as Cherenkov radiators in accelerator-based particle- and nuclear-physics experiments, as well as cosmic ray experiments. For this major application, the adjustable refractive index and optical transparency of the aerogel are highly important. We have been in the process of developing high-quality aerogel tiles for use in a super-B factory experiment (Belle II) to be performed at the High Energy Accelerator Research Organization (KEK), Japan, and for various particle- and nuclear-physics experiments performed (or to be performed) at the Japan Proton Accelerator Complex (J-PARC) since the year 2004. Our recent production technology has enabled us to obtain a hydrophobic aerogel with a wide range of refractive indices (1.0026–1.26) and with an approximately doubled transmission length (i.e., a 400-nm wavelength) in various refractive index regions.

Silica aerogel is also useful as a cosmic dust capture medium. Low-density aerogels can capture almost-intact micron-size dust grains with hypervelocities on the order of several kilometers per second in space, which was first recognized in the 1980s. For this interesting application, the high porosity (i.e., low bulk density below 0.1 g/cm^3; refractive index n < 1.026) and optical transparency of the aerogel are vitally important. The latter characteristic enables one to easily find a cavity under an optical microscope, which is produced in an aerogel by the hypervelocity impact of a dust particle. Aerogel-based cosmic dust collectors were used in several missions aboard spacecraft such as the Space Shuttles and the International Space Station (ISS) in low-Earth orbits. The Stardust spacecraft, which was a deep-space mission by the U.S. National Aeronautics and Space Administration (NASA), retrieved comet and interstellar dust back to Earth successfully in 2006. In support of present-day endeavors, we have developed a next-generation ultralow-density (0.01 g/cm^3; n = 1.003) aerogel for the Tanpopo mission, which is an astrobiological experiment in operation now aboard the ISS.

In this paper, a spin-off application of aerogel as a dust-capture medium in space is described. We provide an overview of the physics behind hypervelocity capture of dust via aerogels and chronicle their history of use as a dust collector. In addition, recent developments regarding the high-performance aerogel used in the Tanpopo mission are discussed.

Primary author: TABATA, Makoto (Chiba University)

Presenter: TABATA, Makoto (Chiba University)

Session Classification: R1-Astrophysics and space instrumentation(2)

Track Classification: Astrophysics and space instrumentation